T07D03 – 7.2a IB Practice MS

1. (a) 200°C 600 atm. *(both for **[1]**, units not needed);* 1
allow the "highest pressure and the lowest temperature"

(b) (i) yield increases/equilibrium moves to the right/more ammonia; 2
4 (gas) molecules → 2/decrease in volume/fewer molecules on right hand side;

(ii) yield decreases/equilibrium moves to the left/less ammonia;
exothermic reaction/*OWTTE*; 2

(c) high pressure expensive/greater cost of operating at high pressure/reinforced pipes *etc*. needed;
lower temperature – greater yield, but **lowers** rate; 2
Do not award a mark just for the word "compromise".

(d) $K_C = \frac{[NH_3]^2}{[N_2][H_2]^3}$ *(ignore units)*; 1

[8]

2. (a) $K/K_C = [SO_3]^2 \div [SO_2]^2[O_2]$; 1
Accept correct K_p expression.

(b) (i) vanadium(V) oxide/(di)vanadium pentaoxide/V_2O_5; 1
Allow just vanadium oxide but not correct formula.

(ii) catalyst does not affect the value of K_C;
forward and reverse rates increase equally/by the same factor;
catalyst increases the rate of the reaction;
(by providing an alternative path for the reaction with) lower activation energy; 4

(c) more energetic collisions/more molecules have energy greater than activation energy;
more frequent collisions; 2
Do not accept more collisions without reference to time.

(d) (i) shifts equilibrium position to the products/right;
to the side with fewer gas molecules or moles/lower volume of gas; 2

(ii) shifts equilibrium position to the products/right;
to compensate for loss of SO_3/produce more SO_3; 2

(iii) no effect;
forward and backward rates increased equally/by the same factor; 2

[14]

3. no effect on position of equilibrium;
forward and reverse reactions speeded up equally/affects the rate of reaction but not the extent of the reaction;
no effect on value of K_C;
no change in concentrations of reactants or products/K_C only changes if temperature alters;

[4]

4. B
5. B
6. C
7. C